AMENDMENTS TO THE CLAIMS

Please amend the claims as set forth hereinbelow.

1. **(currently amended)** ~~A method comprising~~ A method, comprising:

forming a volume hologram in at least a portion of an optical medium, the volume hologram comprising a set of diffractive elements; and

forming first and second optical ports in the optical medium,

wherein:

~~the volume hologram comprising at least one of~~ the diffractive elements of the set are collectively arranged so as to comprise temporal, spectral, ~~and~~ or spatial transformation information,

~~the volume hologram comprising a plurality of diffractive elements exhibiting~~ the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in ~~at least one of~~ amplitude, optical separation, ~~and~~ or spatial phase over some portion of the set, ~~volume of the hologram,~~

each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,

~~the transformation information for transforming~~ the diffractive element set transforms a chosen input optical signal into a chosen output optical signal according to the transformation information as the input and output optical signals propagate within the optical medium between the first and second optical ports.

2. **(currently amended)** The method of Claim 1, wherein the ~~volume hologram is imparted~~ diffractive element set is formed using at least one technique chosen from the group consisting of photolithography, electron beam lithography, stamping, nanoimprinting, laser writing, etching, mechanical abrasion, ultrasonic material removal, heat deformation, laser ablation, and photosensitive exposure, and combinations thereof.

3. **(currently amended)** The method of Claim 1, wherein propagation of the input and output optical signals within the optical medium is substantially unguided in three dimensions.

4. **(currently amended)** The method of Claim 3, ~~the volume hologram comprising~~ wherein the diffractive elements of the set are collectively arranged so as to comprise temporal transformation information.

5. **(currently amended)** The method of Claim 3, ~~the volume hologram comprising~~ wherein the diffractive elements of the set are collectively arranged so as to comprise spectral transformation information.

6. **(currently amended)** The method of Claim 3, ~~the volume hologram comprising~~ wherein the diffractive elements of the set are collectively arranged so as to comprise spatial transformation information.

7. **(currently amended)** The method of Claim 1, wherein the optical medium comprises a planar optical waveguide, and propagation of the input and output optical signals within the planar waveguide is substantially guided in at least one dimension by the planar waveguide.

8. **(currently amended)** The method of Claim 7, comprising imparting a pattern onto at least a portion of at least one surface of the planar optical waveguide, thereby forming the ~~volume hologram~~ diffractive element set therein.

9. **(withdrawn)** The method of Claim 7, comprising imparting a pattern within at least a portion of the volume of the planar optical waveguide, thereby forming the ~~volume hologram~~ diffractive element set therein.

10. **(currently amended)** The method of Claim 7, ~~the volume hologram comprising~~ wherein the diffractive elements of the set are collectively arranged so as to comprise temporal transformation information.

11. **(currently amended)** The method of Claim 7, ~~the volume hologram comprising~~ wherein the diffractive elements of the set are collectively arranged so as to comprise spectral transformation information.

12. **(currently amended)** The method of Claim 7, ~~the volume hologram comprising~~ wherein the diffractive elements of the set are collectively arranged so as to comprise spatial transformation information.

13. **(withdrawn)** ~~A method comprising~~ A method, comprising:

forming first and second optical ports in an optical medium;

calculating a temporal interference pattern that would be produced by an interference of a chosen input optical signal $E_i(t)$ with an intended output optical signal $E_o(t)$, ~~the chosen~~ if the chosen input signal and the intended output signal ~~traveling within a common boundary~~ were to propagate within the optical medium in a common time frame between the first and second optical ports; and ~~frame, the calculated temporal interference pattern for forming a volume hologram in an optical medium.~~

imparting the calculated temporal interference pattern into or onto an optical medium so as to form a volume hologram therein, the volume hologram comprising a set of diffractive elements,

wherein:

the diffractive elements of the set are collectively arranged so as to comprise temporal, spectral, or spatial transformation information,

the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in amplitude, optical separation, or spatial phase over some portion of the set,

each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,

the diffractive element set transforms the chosen input optical signal into the intended output optical signal according to the transformation information as the input and output optical signals propagate within the optical medium between the first and second optical ports.

14. **(cancelled)**

15. **(withdrawn)** The method of Claim 13, further comprising:

calculating a plurality of temporal interference patterns produced by respective interference of a plurality of chosen input optical signals $E_i(t)$ with a respective plurality of intended output optical signals $E_i(t)$; ~~and~~

calculating a total temporal interference pattern as a superposition of the plurality of temporal interference patterns, the total temporal interference pattern for forming a volume hologram in an optical ~~medium.~~ medium; and

imparting the total temporal interference pattern into or onto the optical medium so as to form the volume hologram therein, the volume hologram comprising a plurality of sets of diffractive elements.

16. **(cancelled)**

17. **(withdrawn)** ~~A method comprising~~ A method, comprising:

imparting into the volume of a planar optical waveguide a pattern, thereby forming a volume hologram in the planar waveguide, the volume hologram comprising a set of diffractive elements; and

forming first and second optical ports in the planar optical waveguide,

wherein:

the diffractive elements of the set are collectively arranged so as to comprise ~~at least one of~~ temporal, spectral, ~~and~~ or spatial transformation information,

~~the volume hologram comprising a plurality of diffractive elements exhibiting~~ the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in ~~at least one of~~ amplitude, optical separation, ~~and~~ or spatial phase over some portion of the set, ~~volume of the hologram,~~

each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,

~~the information for transforming~~ the diffractive element set transforms a chosen input optical signal into a chosen output optical signal according to the transformation information as the input and output optical signals propagate within the planar waveguide between the first and second optical ports.

18. **(withdrawn)** The method of Claim 17, wherein ~~the holographic pattern comprises~~ the diffractive elements of the set are collectively arranged so as to comprise temporal and spatial transformation information.

19. **(withdrawn)** The method of Claim 17, wherein ~~the holographic pattern comprises~~ the diffractive elements of the set are collectively arranged so as to comprise spectral and spatial transformation information.

20. **(withdrawn)** The method of Claim 17, wherein the pattern is imparted using a technique chosen from the group consisting of photolithography, electron beam lithography, stamping, etching, mechanical abrasion, ultrasonic material removal, heat deformation, laser ablation, photosensitive exposure, and combinations thereof.

21. **(currently amended)** ~~A method comprising~~ A method, comprising:

imparting onto at least one slab face of a planar optical waveguide a pattern, thereby forming a volume hologram in the planar waveguide, the volume hologram comprising a set of diffractive elements; and

forming first and second optical ports in the planar optical waveguide,

wherein:

the diffractive elements of the set are collectively arranged so as to comprise ~~at least one of~~ temporal, spectral, ~~and~~ or spatial transformation information,

~~the volume hologram comprising a plurality of diffractive elements exhibiting~~ the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in ~~at least one of~~ amplitude, optical separation, ~~and~~ or spatial phase over some portion of the set, ~~volume of the hologram,~~

each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,

~~the information for transforming~~ the diffractive element set transforms a chosen input optical signal into a chosen output optical signal as the input and output optical signals propagate within the planar waveguide between the first and second optical ports.

22. **(currently amended)** The method of claim 21, wherein ~~the volume hologram comprises~~ the diffractive elements of the set are collectively arranged so as to comprise temporal and spatial transformation information.

23. **(currently amended)** The method of claim 21, wherein ~~the volume hologram comprises~~ the diffractive elements of the set are collectively arranged so as to comprise spectral and spatial transformation information.

24. **(original)** The method of Claim 21, wherein the pattern is imparted using a technique chosen from the group consisting of photolithography, electron beam lithography, stamping, nanoimprinting, laser writing, etching, mechanical abrasion, ultrasonic material removal, heat deformation, laser ablation, photosensitive exposure, and combinations thereof.

25. **(original)** The method of Claim 21, wherein the pattern is imparted on two faces of the substrate.

26. **(original)** A product produced according to the method of Claim 21.

27. **(original)** The method of Claim 21, further comprising depositing a layer on at least one slab face of the planar waveguide, and imparting the pattern onto and/or into the layer after deposition thereof on the planar waveguide, thereby imparting the pattern onto the planar waveguide and forming the volume hologram in the planar waveguide.

28. **(original)** The method of Claim 27, wherein the pattern is imparted by spatially-selective deformation of the deposited layer.

29. **(original)** The method of Claim 27, wherein the deposited layer comprises dielectric material.

30. **(original)** The method of Claim 27, wherein the deposited layer comprises metallic material.

31. **(original)** The method of Claim 27, wherein the deposited layer comprises photosensitive material, and the pattern is imparted by spatially-selective photo-exposure of the deposited layer.

32. **(original)** A product produced according to the method of Claim 27.

33. **(withdrawn)** ~~A method comprising~~ A method, comprising:

imparting a pattern into ~~and/or~~ or onto a material layer; ~~and~~

depositing the patterned material layer onto at least one slab face of a planar waveguide substrate after patterning the layer, thereby forming a volume hologram in the waveguide substrate, the volume hologram comprising a set of diffractive elements; and

forming first and second optical ports in the planar optical waveguide,

wherein:

the diffractive elements of the set are collectively arranged so as to comprise ~~at least one of~~ temporal, spectral, ~~and~~ or spatial transformation information,

the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in amplitude, optical separation, or spatial phase over some portion of the set,

each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,

~~the information for transforming~~ the diffractive element set transforms a chosen input optical signal into a chosen output optical signal as the input and output optical signals propagate within the planar waveguide between the first and second optical ports.

34. **(withdrawn)** The method of Claim 33, wherein ~~the transformation information comprises~~ the diffractive elements of the set are collectively arranged so as to comprise temporal and spatial transformation information.

35. **(withdrawn)** The method of Claim 33, wherein ~~the transformation information comprises~~ the diffractive elements of the set are collectively arranged so as to comprise spectral and spatial transformation information.

36. **(withdrawn)** The method of Claim 33, wherein the patterned material layer comprises metallic material.

37. **(withdrawn)** The method of Claim 33, wherein the patterned layer comprises dielectric material.

38. **(withdrawn)** A product produced according to the method of Claim 33.

39. **(withdrawn)** ~~A method comprising~~ A method, comprising:
imparting a pattern onto at least one surface of a support slab; ~~and~~
pressing the support slab securely against a planar waveguide substrate so that the patterned support slab forms a volume hologram in the waveguide substrate, the volume hologram comprising a set of diffractive elements; and
forming first and second optical ports in the planar optical waveguide,
wherein:
the diffractive elements of the set are collectively arranged so as to comprise ~~at least one of~~ temporal, spectral, ~~and~~ or spatial transformation information,
the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in amplitude, optical separation, or spatial phase over some portion of the set,
each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,
~~the information for transforming~~ the diffractive element set transforms a chosen input optical signal into a chosen output optical signal as the input and output optical signals propagate within the planar waveguide between the first and second optical ports.

40. **(withdrawn)** The method of Claim 39, wherein ~~the holographic pattern comprises~~ the diffractive elements of the set are collectively arranged so as to comprise temporal and spatial transformation information.

41. **(withdrawn)** The method of Claim 39, wherein ~~the holographic pattern comprises~~ the diffractive elements of the set are collectively arranged so as to comprise spectral and spatial transformation information.

42. **(withdrawn)** The method of Claim 39, further comprising bonding the support slab to the planar waveguide substrate.

43. **(withdrawn)** A product produced according to the method of Claim 39.

44. **(currently amended)** ~~A method comprising~~ A method, comprising:

imprinting onto at least one slab face of a planar optical waveguide a pattern, thereby forming a volume hologram in the planar waveguide, the volume hologram comprising a set of diffractive elements; and

forming first and second optical ports in the planar optical waveguide,

wherein:

the diffractive elements of the set are collectively arranged so a to comprise ~~at least one of~~ temporal, spectral, ~~and~~ or spatial transformation information,

the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in amplitude, optical separation, or spatial phase over some portion of the set,

each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,

~~the information for transforming~~ the diffractive element set transforms a chosen input optical signal into a chosen output optical signal as the input and output optical signals propagate within the planar waveguide between the first and second optical ports.

45. **(currently amended)** The method of claim 44, wherein ~~the volume hologram comprises~~ the diffractive elements of the set are collectively arranged so as to comprise temporal and spatial transformation information.

46. **(currently amended)** The method of claim 44, wherein ~~the volume hologram comprises~~ the diffractive elements of the set are collectively arranged so as to comprise spectral and spatial transformation information.

47. **(original)** The method of Claim 44, wherein the pattern is imprinted by stamping, embossing, nanoimprinting, or laser writing, or combinations thereof.

48. **(original)** The method of Claim 44, wherein the pattern is imprinted on two faces of the substrate.

49. **(original)** A product produced according to the method of Claim 44.

50. **(original)** The method of Claim 44, further comprising depositing a layer on at least one slab face of the planar waveguide, and imprinting the pattern onto the layer after deposition thereof on the planar waveguide, thereby imparting the pattern onto the planar waveguide and forming the volume hologram in the planar waveguide.

51. **(original)** A product produced according to the method of Claim 50.

52. **(withdrawn)** ~~A method comprising~~ A method, comprising:

spatially selectively exposing a photosensitive optical medium whose exposure changes a physical characteristic of the medium, thereby forming a volume hologram in the medium, the volume hologram comprising a set of diffractive elements; and

forming first and second optical ports in the planar optical waveguide,

wherein:

the diffractive elements of the set are collectively arranged so as to comprise ~~at least one of~~ temporal, spectral, ~~and~~ or spatial transformation information,

~~the volume hologram comprising a plurality of diffractive elements exhibiting~~ the diffractive elements of the set are collectively arranged so as to exhibit a positional variation in ~~at least one of~~ amplitude, optical separation, ~~and~~ or spatial phase over some portion of the volume of the set, ~~hologram,~~

each diffractive element of the set is individually contoured and positioned so as to preferentially route at least a portion of an optical signal between the first and second optical ports as the optical signal propagates within the optical medium,

~~the information for transforming~~ the diffractive element set transforms a chosen input optical signal into a chosen output optical signal as the input and output optical signals propagate within the optical medium between the first and second optical ports.

53. **(withdrawn)** The method of Claim 52, wherein ~~the volume hologram comprises~~ the diffractive elements of the set are collectively arranged so as to comprise temporal and spatial transformation information.

54. **(withdrawn)** The method of Claim 52, wherein ~~the volume hologram comprises~~ the diffractive elements of the set are collectively arranged so as to comprise spectral and spatial transformation information.

55. **(withdrawn)** The method of Claim 52, wherein propagation of the input and output optical signals within the optical medium is substantially unguided in three dimensions.

56. **(withdrawn)** The method of Claim 52, wherein the optical medium comprises a planar optical waveguide, and propagation of the input and output optical signals within the planar waveguide is substantially guided in at least one dimension by the planar waveguide.

57. **(withdrawn)** The method of Claim 52, wherein the physical characteristic that is changed is ~~at least one of~~ absorptivity, index of refraction, ~~and~~ or reflectivity.

58. **(withdrawn)** A product produced according to the method of Claim 52.

59. **(new)** The method of Claim 1, wherein the diffractive element set is formed by stamping or embossing.

60. **(new)** The method of Claim 21, wherein the pattern is imparted by stamping or embossing.

61. **(new)** The method of Claim 27, wherein the pattern is imparted by stamping or embossing.

62. **(new)** The method of Claim 44, wherein the pattern is imprinted by stamping or embossing.

63. **(new)** The method of Claim 15, wherein the diffractive element set is formed by stamping or embossing.

64. **(new)** The method of Claim 17, wherein the diffractive element set is formed by stamping or embossing.

65. **(new)** The method of Claim 33, wherein the pattern is imparted by stamping or embossing.

66. **(new)** The method of Claim 39, wherein the pattern is imparted by stamping or embossing.